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Challenges and Pathways for Graduate Education in Carbon Peaking and Carbon Neutrality Through Deep Industry–Education Integration: A Case Study of Chongqing Technology and Business University

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Abstract: Graduate studies in carbon peaking and carbon neutrality should integrate knowledge from all areas of life. The educational goals of the universities differ, they do not have unified interdisciplinary resources, and the mechanism for continuous cooperation with enterprises is weak. Based on the literature review, questionnaires and interviews mentioned in the source manuscript, this paper studies the problems of educational reform at Chongqing Technology and Business University. Discipline administration and research evaluation are institutional constraints on the development of integrated training. The university will revise the syllabus, spread the division of joint-supervision responsibilities more evenly, and set up training bases that integrate graduate studies with enterprise operations. Curriculum reform combines environmental science, energy technology, economics, management and law to set academic goals and professional requirements. Academic supervisors lead the development of theory and scholarly norms; industry supervisors support practical projects and professional skills. The results are as follows: 8 approved graduate innovation projects, 3 selected management cases, more than 10 competition awards, 2 national scholarship recipients and 3 outstanding thesis awards. Although the results show that interdisciplinary innovation and application ability have increased, no statistics have been published in the current account. Thus, it will be more cost-effective and reasonable, and under good management, cross-disciplinary carbon finance cooperation among regions will continue to be promoted.

Keywords: Carbon Neutrality, Carbon Peaking, Graduate Education, Industry–Education Integration, Interdisciplinary Education, Local Universities.

1. Introduction

1.1. Policy Context and Regional Talent Demand

China has set carbon-peaking and carbon-neutrality goals for itself at the 75th session of the United Nations in September 2020[1]. The report to the Twentieth National Congress then listed the achievements as a large-scale and profound reform of the economic and social system. With the restructuring of the industry, more professionals will be required to link environmental goals and economic choices. Graduate education should prepare students to understand how technological change, enterprise operation, finance and governance interact in the process of reducing emissions.

The origins of this paper are the China Energy Conservation Association's 2023 China Dual-Carbon Talent Employment Development Report and other related industry data[2]. It plans to increase the number of professionals needed in the 14th Five-Year Plan period from around 100,000 today to about 550,000-1 million. The above are contextual estimations reproduced in the manuscript. The reported shortage is for both the quantity of available staff and the supply of highly skilled professionals with various specialisations. Expanding enrollment alone cannot solve this problem; we need to change what graduates are taught.

The 2022 work plan of the Ministry of Education to strengthen higher education support for carbon peaking and carbon neutrality requires the integration of science and technology, engineering,agriculture,economics, management, law, etc[3]. The foundations of all schools should meet the demands of the local economy. Through the study of literature, questionnaires and interviews, as shown in the provided manuscript, this paper presents the present case. Since the account does not list respondent numbers, questionnaire items, interview procedures or statistical methods, this paper will only present the reform and results achieved without reconstructing the missing methodological details[4].

1.2. Educational Initiatives and the Research Context

The institutional problem is the result of the above initiatives. The original work mentioned the interdisciplinary sustainability modules at the University of Greifswald in Germany and the seminars and workshops for spreading low-carbon ideas. Multidisciplinary teaching at the University of Siena in Italy is also being promoted to help improve social inclusion under the banner of sustainability. The above are examples of the types mentioned in the paper.

In China, the manuscript presents the development of combining carbon education with other subjects. In 2017, Shanghai Jiao Tong University established the China-UK low-carbon college to cultivate young talents and promote the development of green technology. Shandong University of Finance and Economics has introduced courses on low-carbon economy and management. In 2022, the finance school of Zhongnan University of Economics and Law added carbon trading and carbon finance to its list of professional master's programs. The reported cases are from different organisations. The paper does not propose any specific ways to improve the system of interdisciplinary graduate education at present, and therefore does not focus on changes in local

universities.

2. Challenges in Graduate Education

2.1. Educational Objectives and Diverse Market Needs

With the new-energy system and new-business model transformation, new challenges have emerged for graduates; therefore, they need to address all these problems. Employers need to know about other areas in order to address environmental problems that affect all parts of the company. However, graduate studies have not been sufficiently reformed to prepare students for this. Adding a carbon-related label to the existing program will not provide all the necessary knowledge and cross-disciplinary judgment to deal with the actual problems of industrial transformation[5].

Part of the reason for this discrepancy is the institutional organisation of graduate admissions and education. Local universities are in the first level of the discipline catalog, and their freedom to establish interdisciplinary research directions is restricted by the approval system. Educational Goals will change more gradually than market demands. The above division is due to a lack of rules in the universities for organising courses and other activities. Extra courses can add more content to the subjects, but they cannot correct the problems in programme management. Reform should offer training in serious carbon problems and maintain a high standard of education.

2.2. Interdisciplinary Teaching and Resource Constraints

Interdisciplinary aspiration is also absent from the teaching materials and research institutions. The list of faculty involved in carbon peaking and carbon neutrality is short, their expertise is not uniform, and the research results are scattered. High-end equipment and good multidisciplinary research platforms are still not available, and an organised system of knowledge teaching materials has not been built. Without joint teaching and platforms, the contributions of these disciplines may remain separate, and students will have to integrate knowledge that the institution has not organised.

Faculty evaluation is not in the group. If promotion and performance evaluations are based only on the results of one area, less attention will be paid to cross-disciplinary teaching and research. Therefore, faculty are less motivated to participate in the joint development or coordination of the curriculum. Administrative barriers still exist because the work to be done is not properly compensated. Although more equipment and individual skills can boost the scale, continuous cooperation among teachers in collaborative teaching, supervision and application research is also necessary for this.

2.3. Weak Mechanisms for Industry Collaboration

The third is a lack of depth in the industry. As shown in the manuscript, carbon-related graduate education at local universities is still in its early stages and does not have institutional support for industry-education cooperation. Programs that combine majors and minors, links between industry and universities and research and application have been introduced, but there are still delays in implementation and other operational problems. Industry experience should be introduced into education through practical application and not just as a name-of-the-act cooperation[6].

The above is reflected in the curriculum. Programs may add a research direction but do not build a whole curriculum for carbon peaking and carbon neutrality. There is no standardised core content and assessment standards, and new technologies have not been applied in teaching. Therefore, the quality of the preparing graduates is lower. The three problems are at different levels in the same process: Goals set the direction, Resources provide the means, and industry cooperation creates application opportunities. The above problems have been solved by the curriculum reform, joint supervision and enterprise-based training foundation in Chongqing.

3. Industry–Education Collaborative Pathways

The manufacturing economy in Chongqing needs more professionals who understand industrial carbon reduction, carbon market trading, green financial products and enterprise carbon accounting. In light of the reform and innovation of green finance in the city, this paper addresses such demands. Chongqing Technology and Business University will use its existing strengths in economics and management to address the industrial problems in the region. Given the current disciplinary strengths of the university, how can we improve the preparation of graduates for carbon-related industries by integrating knowledge from different fields and strengthening continuous industrial collaboration?

3.1. Curriculum Reconstruction Across Disciplinary and Administrative Barriers

Curriculum reform will address the problems of division among subjects and departments. It does not ignore disciplines or disregard special knowledge. Based on the actual problems of carbon peaking and carbon neutrality, organise the knowledge modules and integrate the contributions of all departments into a single educational system. The university will use the existing materials from the well-known graduate course "Research on Financial Management Theory" in Chongqing. Environmental science, energy technology, economics, management and law are all included in the curriculum.

Curriculum Reconstruction distinguishes between educational goals and life goals. Students of higher education are more focused on the general mechanisms and policies of the environment-economy relationship. Students of higher education are more concerned about how to use carbon trading and carbon auditing to solve actual problems. In this way, interdisciplinary education will not be a general assembly of separate subjects. Both ways aim for an all-encompassing knowledge, but they have different focuses in education. The method of division shown in the paper is to help students face actual problems in the environment and economy[7].

3.2. Dual Supervision with Defined Responsibilities

To address the problem of dispersed practical experience, a dual-supervisor system will be established at the university. Internal staff provide their knowledge of the application of low-carbon technology, carbon management, carbon auditing, artificial intelligence and education. An economist from the Fuling branch of Chongqing United Assets and Equity

Exchange Group is supervising. Organise the study in line with the actual requirements of the industry and work.

List the Responsibilities Explicitly. University supervisors provide the theoretical basis, teach students good study habits and how to write graduation theses. Industry supervisors are aware of changes in the industry and organises related training programs. Once a month, the two parties will have a joint supervision meeting to talk about the graduate's training plan and research topics. This way, coordination has been given a place in training and the academic and practical aspects can be addressed together.

It will show how much outside intervention is needed. Industry participation can provide practical knowledge of the carbon market that is lacking among university faculty, and academic supervision can offer theoretical development and scholarly norms. According to the manuscript, this way can solve the problems of faculty experience in the carbon market.

3.3. An Operational Joint Training Base

A good place for regular collaboration is needed for the application. With the support of the local education authorities, the university obtained approval from and established the Chongqing Kanghua Accounting Firm Joint Training Base for the Master of Professional Accounting program. The municipal graduate joint-training base links graduate education with the company. The real purpose is that an agreement alone does not provide conditions for actual learning.

Internships and other practical training will be added to the foundation of the company's carbon emission inventory, carbon auditing and risk assessment. The supervision team helps the graduate students and enterprise managers carry out the research and collect the project data. The above activities can connect the university's economics and management orientation with the environmental information and professional judgment demands of enterprises. Students will learn about the carbon problem in their daily lives and gain some theoretical knowledge as a result.

The Foundation will support the other reforms and provide a place for connection. Reconstructed courses have interdisciplinary knowledge, are jointly led by academia and practice, and enterprise projects have their own research problems. Therefore, it has begun to address the problem of the education-industry gap.

4. Evaluation of Educational Outcomes

Educational results will be evaluated based on research and innovation, application results, individual honours, etc. According to the above data, there have been continuous educational reforms and new advantages in differentiated talent development. Research on Project Approval Documents: Select some typical cases and awards to present the good achievements, and based on the results of this research, develop teaching materials for education.

4.1. Interdisciplinary Research Innovation

The manuscript reports gains in interdisciplinary research innovation among students participating in the reformed training system. Compared with nonparticipating graduate students in the same major, participants' project approval rates are described as markedly higher than the average for their year. The available account provides neither group sizes nor approval percentages and does not describe statistical tests. The finding therefore remains a reported comparative educational outcome rather than an estimated effect or independently established causal relationship.

Students obtained approval for eight municipal and university graduate innovation projects through the interdisciplinary platform. Examples include research on how digital transformation affects corporate carbon risk, how state auditing influences corporate carbon risk and its mechanisms, and how digital finance enables carbon reduction in manufacturing. These topics connect environmental questions with economics, management, auditing, and finance. The manuscript interprets them as evidence of strong problem-oriented awareness and interdisciplinary innovation. The count records approved projects rather than completed findings or measured reductions in enterprise emissions.

4.2. Applied Cases and Competition Achievements

Under dual supervision and through base participation, the proportion of students receiving case competition awards reportedly increased substantially. Three business cases developed through enterprise investigation were selected by the China Management Case Sharing Center. Two supplied translated titles are “Growing Through Change: How Ruhnn Became the First Listed Influencer Company” and “Lavish Spending, Ultimately Exhausted: Pengboshi Company’s Journey of Buying and Selling Great Wall Broadband.” The source identifies all three cases as concerning enterprise transformation in the dual-carbon context. Their selection supports reported applied case development without establishing independently assessed environmental outcomes.

Students also received more than ten national, provincial, and ministerial awards in major competitions, including a gold award in Chongqing’s Challenge Cup. The manuscript treats these achievements as evidence that industry–education integration strengthens practical implementation capabilities. The source provides no total number of entries or participating students, however, and the reported increase in award share cannot be expressed as a numerical change. The evidence supports the stated direction of improvement while retaining the original limits on comparison precision.

4.3. Student Distinctions and Teaching–Research Interaction

Two of the participating students won national schola rships, and three were named as the best thesis student s. The above are particular achievements that show the cultivation of outstanding talents according to the manus cript. They do not set the proportion of recognised part icipants because the total population of participants is u nknown. In conjunction with innovation projects and co mpetition results, the various forms of the source docu ments indicate different aspects of educational quality[8].

The reforms will also affect the research and teachin g of faculty. Faculty members have been using the resu lts of more than ten national, provincial and department al projects in their teaching, such as studies on total-en ergy-consumption control of China and carbon-emission peak pathways in Chongqing. The team has also release d the "Carbon Finance Trading Market Training Materia ls" and the "Green and Low-Carbon Energy" industry tr aining materials in cooperation with the Chongqing Dev elopment and Reform Commission and the Chongqing Low-Carbon Association. The activities in the manuscrip t form a cycle of teaching improvement based on resea

rch and are supported by interdisciplinary education.

5. Conclusion and Outlook

5.1. A Differentiated Pathway for Local Universities

Therefore, local universities with strong economics and management will be given preferential treatment in this case. Its main features are the above, and they have been extended into carbon management and carbon finance through cooperation with local industries. This path is not the one chosen by top universities with ample funds for scientific and technological research. The Difference is in the institutions and educational goals. Build interdisciplinary knowledge and cooperation platforms to increase the regional influence of the university and attract more funds.

According to the above information, this model is relatively low-cost, simple to implement, meets the needs of the region, and has also been applied by other universities in central and western China. These are the manuscript's conclusions on transferability, not the results of comparative cost analysis. Based on the current strengths of the institution, develop coordinated curricula, supervision and training. The reasons are as follows: Strict disciplinary regulations, narrow research evaluation, lack of support for collaboration, etc.

5.2. Coordinated Institutional Reforms

Going forward, the government, universities and enterprises need to work together. Strengthen the planning and increase the investment in cross-disciplinary experimental platforms and joint-training bases by the government and education departments. More policy flexibility is needed so that the local universities can organise interdisciplinary education in light of the new demands.

Universities should add the construction of interdisciplinary courses, joint graduate supervision and industry-education projects to the faculty performance evaluation and promotion system. Acknowledge the contributions made by different departments to motivate ongoing cooperation among them. The company should continue to provide long-term incentives for employees' participation in all kinds of activities and cooperation. Together, these reforms will strengthen the cultivation of high-end talents who can drive all-weather green and low-carbon development in the economy and society.

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